

Reference 54

1996 Regional Assessment of

Water Quality in the Nueces Coastal Basins

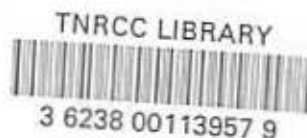
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1996 Regional Assessment of Water Quality in the Nueces Coastal Basins

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TNRCC Clean Rivers Program

October 1996

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EXECUTIVE SUMMARY

Introduction

The 1996 Nueces Coastal Basins Regional Assessment of Water Quality focuses on two coastal watersheds in South Texas: the San Antonio-Nueces Basin, and a portion of the Nueces-Rio Grande Basin. The two watersheds are jointly referred to as the Nueces Coastal Basins. The Clean Rivers Program (CRP), under the auspices of the Texas Natural Resource Conservation Commission (TNRCC), formulated 11 objectives, or tasks, to be accomplished in FY (fiscal year) 95 and FY 96 to deal with water quality and water management issues throughout the region. Inherent in these objectives was coordination among the multiple cooperating agencies and institutions which conducted the studies for this assessment. The primary participants for the FY 95-96 program were the Corpus Christi Bay National Estuary Program (CCBNEP), the TNRCC Region 14 office, the Nueces River Authority, Texas A & M University, the University of Texas, the city of Corpus Christi, the Natural Resources Conservation Service, the U.S. Environmental Protection Agency, and the U.S. Geological Survey.

Assessment Focus

During FY 95 and FY 96, four of 11 tasks focused on gaining a more thorough understanding of the basins through the acquisition of data. The results of these tasks will enable local agencies and public participants to develop management strategies for the NCB. The four tasks were to:

- Maintain and analyze current and historic water quality data
- Perform a watershed-specific priority task
- Conduct a basin water quality monitoring program
- Conduct a targeted monitoring program to support the permitting process

Substantial progress was made in FY 95 and FY 96 towards the accomplishment of these objectives. Seven studies were completed within this focus during the assessment period, and another five are currently in progress. These studies are discussed here under "Findings." Another six have been identified as specific future studies for FY 97.

A monitoring questionnaire was designed and mailed to more than 200 members of the monitoring community in the basins to acquire a monitoring database. Targeted monitoring programs were initiated to provide support to the TNRCC wastewater discharge permitting process. The assessments both provide data to the TNRCC standards team, who will assign an aquatic life use designation to receiving waters, and provide valuable data to set permit limits.



Another task within the FY 95-96 program was to identify and prioritize water quality concerns and causes of pollution.

The CRP conducted a ranking of water quality by segment for the Nueces Coastal Basins. This ranking, along with data input from the various studies conducted, will provide a basis for the development of a basinwide monitoring plan as well as prioritize the segments for future funding.

Of the 11 CRP objectives, three focused on involvement with or for the public:

- Promote public outreach and involvement
- Promote water conservation
- Maintain a data clearinghouse for watershed inventory

A CRP goal was to promote public involvement through citizen steering committees and other public forums designed to encourage citizens to participate in defining problems in the basin and proposing solutions to them. The 42-member steering committee consists of representatives from state agencies, municipalities, water conservation districts, educational institutions, and nonprofit organizations. The CRP developed and acquired a variety of outreach materials, which were distributed at festivals and conferences, and a monitoring questionnaire was mailed to more than 200 members of the community. The CRP is also participating in the CCBNEP action planning task forces, which are providing community and stakeholder input into the CCBNEP Comprehensive Conservation and Management Plan. These task forces provide an excellent opportunity for coordination between the various agencies, institutions, and industries in the Nueces Coastal Basins. They deal with a number of basin issues, such as public health, water/sediment quality, brown tide, bay debris, freshwater resources, point source discharges, and public outreach, among others.

Although the water conservation objective was prioritized for the 1998 assessment period, the prevailing drought conditions warranted more immediate attention. In response, the CRP is coordinating the development and distribution of materials to encourage businesses to conserve water. The city of Corpus Christi created a card to be placed in hotel rooms with which guests can select whether to have linens laundered each day. Other materials have been distributed at area events.

In addition to these efforts to involve the public, an integrated data management system is being developed through the CRP, and is being implemented by Texas A&M University at Corpus Christi. It will serve residents, researchers, industries, and governmental agencies in both the Nueces River Basin and the Nueces Coastal Basins. The database system will be accessible by way of the World Wide Web.

Of the remaining objectives, one was project administration, another was the preparation of this assessment report, and the third, to assess the potential for water pollution from groundwater-surface water interactions, was prioritized for the 1998 assessment period.



Findings

Many studies are currently in progress, or have been completed over the past two years, that characterize the status and trends associated with priority issues in the Nueces Coastal Basins. These studies are the results of the efforts of many academic and governmental participants in these basins. The CRP has compiled summaries of these studies into this document to make them more accessible to the public.

Status and Trends of Water Quality in the Nueces Coastal Basins

This project compiled data from over 30 separate data collection programs or projects in the Nueces Coastal Basins, including the three major current monitoring programs administered by the state: (1) the TNRCC Statewide Monitoring Network, (2) the coastal fisheries surveys of the Texas Parks and Wildlife Department, and (3) the Shellfish Sanitation program of the Texas Department of Health.

For each of 113 water quality parameters and 83 sediment quality parameters, a master data file was created. For many parameters, the data record extends back as least 20 years, and for a few conventional parameters, back to the early 1950s. This compilation is the most extensive and detailed long-term record of water and sediment quality assembled for the Nueces Coastal Basins.

Separate statistical analyses were performed on the data for the numerous parameters. Time trends were also determined for the various parameters. The parameters reported in this summary included dissolved oxygen, salinity, total suspended solids, fecal coliform bacteria, nutrients, total organic carbon, and metals.

Dissolved oxygen was found to be generally high throughout the bays in the Nueces Coastal Basins. The exception was the Corpus Christi Inner Harbor, which is deep, poorly flushed, and subject to waste discharges. No statistically significant trends were found in dissolved oxygen within the study area.

In many ways, salinity is an important delimiter for habitat in bays. An increasing trend in salinity was found throughout the Nueces Coastal Basins bay systems, with the exception of Mesquite Bay, San Antonio Bay, and the Upper Laguna Madre, where an opposite trend of declining salinity was shown. The Aransas-Copano Bay system has several sources of inflow and a relatively constrained interaction with the sea, so the salinity gradient across the bay was shown to be substantial, while the salinities in the main Corpus Christi Bay system were higher and more uniform.

The pattern of total suspended solids distribution was shown to be higher concentrations in the shallower, interior bays and lower values in the deeper, seaward bay segments. A statistically significant widespread declining trend in total suspended solids throughout the study area was revealed by this analysis.

Contaminants and their indicators, including biochemical oxygen demand, oil and grease, and fecal coliform bacteria, showed elevated levels in regions of runoff and waste discharge. These elevated levels were noted in the Corpus Christi Inner Harbor, Corpus Christi Bay, and Nueces Bay. Fecal coliforms were found to be at higher concentrations in Corpus Christi Bay, but with a declining trend. Declining trends in biochemical oxygen demand were generally found throughout the study area, with the exception of an increasing trend in Oso and Nueces Bays and no detected trend in Corpus Christi Bay.

Nutrients were found to be in higher concentrations in regions of inflow and waste discharge. Increasing trends were seen to be statistically significant for phosphorus in the study area. Nitrate, on the other hand, evidenced a declining trend with a few exceptions. The levels of total organic carbon in the Corpus Christi Bay system are not excessive for a productive estuary. The spatial distribution generally followed that of other nutrients, of being higher in the interior segments more subject to inflow and wastewater. The trend analyses revealed declining total organic carbon through the study area systems.

The database for waterborne metals is highly varied, and statistically significant patterns were unusual. Several of the metals, such as arsenic, mercury, and lead, showed higher values in Nueces Bay, as well as some of the other interior regions of the study area. Generally, where a trend was revealed, waterborne metals concentrations were declining.

Fecal Coliform/Water Quality Investigation of the City of Ingleside on the Bay Canal System and Adjacent Waters of Corpus Christi Bay

The TNRCC Region 14 office conducted an investigation to determine the incidence of fecal coliform bacteria concentrations in the canal systems of Ingleside on the Bay and adjacent waters. Fecal coliform bacteria are indicators of pathogens that could be a public health risk. Effluent from on-site sewage disposal systems in Ingleside on the Bay could potentially contribute excessive densities of fecal coliform bacteria into these waters. Corpus Christi Bay is used for both contact recreation and shellfish harvesting.

The field and bacteriological data collected during the investigation showed that although higher fecal coliform densities were found in the canals following heavy rainfall events, these conditions did not persist over time. The bacteriological data did not violate the Texas Surface Water Quality Standards criterion for contact recreation use waters; however, the data did violate standards for shellfish harvesting waters. Individual bacteriological densities measured within the waterfront community canal system were generally higher than typically observed in estuarine waters. The predominantly closed nature of the canal system would be expected to retain bacteria to a greater extent than areas with less restricted circulation, and the use of on-site sewage systems by the canal residents may contribute to the observed bacteriological densities.



An Assessment of Water Quality Standards Attainment in St. Charles Bay, Oso Bay, and Upper Laguna Madre

In response to the 1992 State of Texas Water Quality Inventory 305(b) Report, which listed several coastal waters within Region 14 as "water quality limited," a second water quality study was completed by TNRCC staff in 1995. The designated uses for St. Charles Bay, Oso Bay, and Upper Laguna Madre are contact recreation, exceptional quality aquatic habitat, and oyster waters.

General conditions of water quality for the three water bodies were determined from a designated percentage of survey measurements, which included fecal coliform bacteria, dissolved oxygen, temperature, and pH. Data from the study segments revealed no violations of the Texas Surface Water Quality Standards criteria defined for their designated water uses. When compared to the criteria established in the 1992 305(b) report for surface water assessment and segment classification, the contact recreation use was found to be "fully supported" in all three water bodies. The exceptional quality aquatic habitat use designation was "fully supported" in St. Charles Bay and "partially supported" in both Oso Bay and Upper Laguna Madre.

Characterization of Nonpoint Sources and Loadings to Corpus Christi Bay National Estuary Program Study Area

This investigation provided a general overview of possible nonpoint sources of pollution and related impacts in the CCBNEP study area from all relevant literature and data available for the area. Seven land use categories and 22 nonpoint pollution constituents were considered. The land use categories were cropland, rangeland, residential, commercial, industrial, transportation, and undeveloped or open land. The more common nonpoint source constituents were nitrogen (various forms), phosphorus (various forms), suspended solids, dissolved solids, metals, biochemical oxygen demand, fecal coliform bacteria, and pesticides.

In the evaluation of urban data, values for metals were lower than those reported by the Nationwide Urban Runoff Program. The data showed the area to be relatively free of pesticides and organic compounds. Total and dissolved phosphorus concentrations were higher than those found in other studies examined in this investigation. Biochemical oxygen demand was higher, as were fecal coliform bacteria and fecal streptococcus concentrations.

In general, the potential for agricultural nonpoint source pollution was found to be lower in the study area than in most other areas of the state. When compared to other areas, nutrients and dissolved solids values for cropland were found to be much higher, but suspended solids, biological oxygen demand, and fecal coliform bacterial levels were substantially lower.



Geographic Information Systems Assessment of Nonpoint Source Pollution Loadings in the San Antonio-Nueces Coastal Basins

A geographic information systems (GIS) method for assessing nonpoint source pollution was developed and then tested on the San Antonio-Nueces Basin. The computer model digitizes topographical data, establishes a mathematical relationship between rainfall and runoff, assigns pollutant values to each of several land use categories, estimates average annual pollutant loadings throughout the basin, and computes the expected concentration distribution for individual pollutants.

With some limitations, the GIS model was found to be a viable technique of characterizing the nonpoint source contributions to pollution within a watershed or geographic area. Predicted concentrations determined by the GIS method matched well with observed concentration values. The method also provides an efficient way to identify specific locations or regions where elevated levels of pollutant concentrations may be expected. A logistical advantage of the method is that it makes use of public streamflow and pollutant concentration data and synthesizes the data in a consistent and logical way across a basin or study area. Finally, predicted concentration levels in larger streams where point sources are known to exist may be more closely correlated with average observed concentrations.

The King Ranch Nonpoint Source Projects

Two watershed-specific projects have been initiated at the King Ranch. One is privately funded; the other is funded by the CCBNEP. The first study will characterize the loadings of nonpoint source pollution that may be originating from croplands that drain to Baffin Bay. The object of this project is to determine if trends in loadings can be observed and related to specific agricultural practices or seasonal variations.

The second study is an analysis of the possible effect of nonpoint source constituents on the brown tide problem that has plagued Baffin Bay since 1990. Brown tide is a persistent bloom of small phytoplankton species. The bloom has reduced the clarity of the water and thus the ability for seagrass beds to photosynthesize. Seagrass beds are an important nursery habitat for fish and an essential winter food resource for migrating waterfowl. The seagrass beds in Baffin Bay and Laguna Madre are the most extensive in Texas. If the results of both studies show a nutrient effect on the brown tide, then methods for reducing nutrient input into the bay may reduce the problem.

Bay/Marine Debris - Current Status and Historical Trends

The Nueces Coastal Basins region is noted as having some of the most littered beaches in the world. This project concentrated on an examination of existing literature and data to determine the current status and historical trends in the incidence of marine and bay litter in the Nueces Coastal Basins. Highlights of the study included: literature and data concerning marine debris are more prevalent for gulf beaches than for bay shorelines and beaches; plastics are the most dominant debris material found in the study area; approximately 30



percent of marine debris comes from shrimping activities; tarballs have diminished considerably since 1990; and a downward trend has been recorded in the quantity of marine debris on Mustang Island, although quantities of some particular items have increased.

Although the assessment yielded useful information, a large disparity was found in sources and reporting of data. Survey methods need to be re-examined by all data gatherers.

Current Status and Historical Trends in Freshwater Inflows

The U.S. Geological Survey, through a project funded by the CCBNEP, characterized the status and trends of freshwater inflows into the CCBNEP study area. The study encompassed a compilation and review of data and previous studies of freshwater inflow investigations in the area, a hydrologic analysis using a rainfall-runoff model, and statistical analyses. The three selected watersheds with streamflow gauges were Oso Creek at Corpus Christi, Copano Creek near Refugio, and the Aransas River near Skidmore. Three scenarios were applied to each watershed: the current land use; the projected land use; and the naturalized (pre-buildout) inflow conditions. Results were combined according to which bay system the watersheds contribute to, and a final analysis was then made.

Under current conditions, the Copano Bay system contributed 52 percent of total inflows, the Nueces-Corpus Christi Bay system contributed 33 percent, and the Baffin Bay system contributed about 8 percent. Remaining watersheds contributed the remaining 7 percent of total inflows. Analysis of the three scenarios indicates that the percent changes in flow are greater in magnitude for the natural to current comparison than for the current to future comparison.

To gain more accurate data for determining freshwater inflows, more gauging stations are needed throughout the study area. Additionally, updated and precise land use data is also needed for future studies.

Trace Metals Distribution in Nueces Bay Sediments

Recent evidence from TNRCC environmental monitoring efforts suggest that the sediment quality of Nueces Bay may be diminishing due to metals contamination. TNRCC surface water quality data have shown elevated levels of zinc and cadmium in sediments near the south shore of the bay. An extensive investigation of Nueces Bay that will describe the concentration and distribution of trace metals in the sediments is scheduled for completion by 1997. TNRCC Region 14 researchers will examine the significance of these findings with respect to established screening criteria for metals in estuarine sediments.

Targeted Monitoring

Receiving Water Assessments

To provide permit support for priority wastewater dischargers in the basins' area, and to expand upon the basinwide monitoring effort, the Clean Rivers Program reviewed permittees



who discharge into a perennial stream. After consideration of three permittees who are due for permit review, it was determined that only the city of Ingleside discharges to a stream with potentially high quality aquatic life use. The Region 14 office collected physical and biological data and then determined that the city's wastewater treatment plant has no detrimental impact on the upstream or downstream portion of its receiving stream, Kinney Bayou. The assessment will provide data to the TNRCC standards team, who will assign an aquatic life use designation to the bayou. Based on this designation, permit limits will be set for the plant's discharge.

Allison Wastewater Treatment Plant Effluent Diversion Demonstration Project

The city of Corpus Christi has proposed a wetland demonstration project, which will use 2.8 million gallons per day of treated wastewater discharge from its treatment plant as a supplemental source of freshwater inflows to the Nueces River Delta for ecological maintenance and enhancement. A monitoring program to collect baseline data will begin at a minimum of three months before the treated wastewater is delivered to the receiving stream. This monitoring project will become a component of the basinwide monitoring efforts.

Water Body Segments and Segment Ranking

The CRP has conducted a ranking of water quality by segment for the Nueces Coastal Basins. The segment ranking process looks at the water quality, resource uses, and the potential impacts of man on the various water bodies in the state, as well as the local priority of each segment. TNRCC compiles all rankings into a statewide ranking list. This ranking list, along with data input from the various studies conducted, will provide a basis for the development of the basinwide monitoring plan as well as prioritize the segments for future funding.

Long-Term Planning

Based upon the results of the assessments conducted over the past two years, a number of issues became evident. Most prevalent is a lack of data in the region upon which to base long-term management strategies. Deficiencies were found in toxic substances and metals measurements, pesticide and other organic concentrations data, streamflow and rainfall data, information on loadings from septic systems, biological, land use, atmospheric deposition, and bay debris data, knowledge of brown tide survival and growth factors, and information on the effects of marinas on water quality. Programs to alleviate some of these deficiencies have been developed during this assessment period. These include: septic system studies and demonstration projects; a total constituent loadings model for the Nueces Coastal Basins; urban nonpoint source pollution reduction projects; an analysis of the effects of structures and practices on circulation and salinity patterns; a history of alterations to bay circulation; and an assessment of additional methods to obtain streamflow data.



Another long-term planning tool is the development of a basinwide water quality monitoring plan. An objective of the CRP is to conduct basin monitoring activities in accordance with an approved sampling plan that contains a monitoring schedule, parameters, and sampling locations. A main focus will be to coordinate this plan with the CCBNEP's development of their Coastal Bend Bays Plan and the Region 14 office's yearly water quality monitoring plan.

Recommendations

The overall goal of the CRP in the Nueces Coastal Basins is to develop ongoing management strategies that will maintain and enhance water quality in the region. To accomplish this end, the following recommendations are made:

1. Continue to establish a local database of all water quality monitoring data within the Nueces Coastal Basins area
2. Review and improve existing monitoring programs
3. Collect additional biological, toxic substances, metals, rainfall, streamflow data for future water quality analyses
4. Rank identified contaminated areas and focus research and assessments in these areas
5. Continue and expand projects to characterize and to identify sources for point and nonpoint source pollution in the Nueces Coastal Basins
6. Develop a plan for reducing pollutant loads for an affected part of the bay system
7. Encourage voluntary implementation of best management practices to minimize urban and agricultural nonpoint source pollutant loadings
8. Determine whether the bay system is nutrient-rich or nutrient-deficient when compared to historical water quality; study the ability of the bay system to make adjustments
9. Study water quality conditions, especially bacteriological, as a result of septic systems, and increase enforcement of existing rules and regulations; consider conducting a septic tank demonstration project
10. Review water quality standards, numerical criteria, and designated uses for each part of the bay system and revise them as needed



11. Ensure that research results and updates on water quality status are communicated to the public
12. Continue to develop informational and educational materials for interested citizens in the bay area on ways that they can protect water quality and actively conserve water



LIST OF ACRONYMS

BDL	Below Detection Limit
BMP	Best Management Practices
BOD	Biochemical Oxygen Demand
CBCOG	Coastal Bend Council of Governments
CC	Corpus Christi
CCBNEP	Corpus Christi Bay National Estuary Program
CCMP	Comprehensive Conservation and Management Plan
COE	United States Army Corps of Engineers
CRP	Clean Rivers Program
DEM	Digital Elevation Model
DLG	Digital Line Graph
DO	Dissolved Oxygen
EDAP	Economically Distressed Areas Program
EMC	Event Mean Concentration
EPA	Environmental Protection Agency
GBNEP	Galveston Bay National Estuary Program
GCCA-CPL	Gulf Coast Conservation Association-Central Power and Light
GLO	General Land Office
GPS	Global Positioning System
HHW	Household Hazardous Waste
HUC	Hydrologic Unit Codes
LCC	Lake Corpus Christi
LULC	Land Use/Land Cover
MWD	Municipal Water District
NADP	National Atmospheric Deposition Program
NCB	Nueces Coastal Basins
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NRA	Nueces River Authority
NRCS	Natural Resources Conservation Service
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PRISM	Parameter-Elevation Regressions on Independent Slopes Model



LIST OF ACRONYMS

QA/QC	Quality Assurance/Quality Control
RCT	Railroad Commission of Texas
SWQM	Surface Water Quality Monitoring
TAMU	Texas A&M University
TAMU-AREC	Texas A&M University Agricultural Research and Extension Center
TAMU-CC	Texas A&M University in Corpus Christi
TDH	Texas Department of Health
TNRCC	Texas Natural Resource Conservation Commission
TOC	Total Organic Carbon
TPWD	Texas Parks and Wildlife Department
TSS	Total Suspended Solids
TSSWCB	Texas State Soil and Water Conservation Board
TSWQS	Texas Surface Water Quality Standards
TWC	Texas Water Commission
TWDB	Texas Water Development Board
TXDOT	Texas Department of Transportation
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UT	University of Texas
UTMSI	University of Texas Marine Science Institute



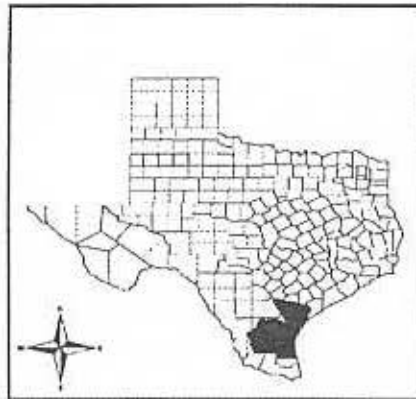
The Nueces-Rio Grande Basin is bordered on the north and west by the Nueces River Basin, and on the west and south by the Rio Grande Basin. To the east lie bays, estuaries, Padre Island National Seashore, and the Gulf of Mexico. The economy of the basin is centered primarily around agriculture, manufacturing, mineral production, commercial fishing, tourism, and military activities. The larger population centers of the basin include Corpus Christi, Kingsville, Alice, and Robstown.

The water quality analysis for these two basins includes both fresh and marine water bodies. Table 1.4 shows the main water bodies within each of the two basins and the associated segment numbers assigned by the TNRCC. The location of these segments is presented in Figure 1.2.

Table 1.4: Segments in the Nueces Coastal Basins Listed by Basin

San Antonio-Nueces	Nueces-Rio Grande
2001- Mission River Tidal	2203- Petronila Creek Tidal
2002- Mission River above Tidal	2204- Petronila Creek above Tidal
2003- Aransas River Tidal	2484- Corpus Christi Inner Harbor
2004- Aransas River above Tidal	2485- Oso Bay
2462- San Antonio/Hynes/Guadalupe Bay	2491- Upper Laguna Madre
2463- Mesquite/Carlos/Ayres Bay	2492- Baffin/Alazan Bay and Cayo del Grullo
2471- Aransas Bay	
2472- Mission/Copano/Port Bay	
2473- St. Charles Bay	
2481- Corpus Christi Bay	
2482- Nueces Bay	
2483- Redfish Bay	

Figure 1.2. Nueces Coastal Basins Segments



Legend

- County Lines
- Streams
- Segment Boundaries
- 2001 Segment Number
- Cities
- Water Bodies

Nueces - Rio Grande Basin

- 2203: Petronilla Creek Tidal
- 2204: Petronilla Creek Above Tide
- 2481: Corpus Christi Bay
- 2484: Corpus Christi Inner Harbor
- 2485: Oso Bay
- 2491: Upper Laguna Madre
- 2492: Raffin Bay, Alazan Bay, and Cayo del Grulla

San Antonio - Nueces Basin

- 2001: Mission River Tidal
- 2002: Mission River Above Tide
- 2003: Aransas River Tidal
- 2004: Aransas River Above Tide
- 2462: San Antonio Bay
- 2463: Mesquite Bay
- 2471: Aransas Bay
- 2472: Copano and Mission Bays
- 2473: St. Charles Bay
- 2482: Nueces Bay
- 2483: Redfish Bay





Mesquite Bay/Carlos Bay/Ayres Bay (Segment 2463) - This is an enclosed bay system that connects San Antonio Bay to the north and to Aransas Bay to the south. No concerns are identified for this segment. Possible concerns include total phosphate and orthophosphate. Trend analysis shows that the concentrations of total phosphorus and nitrate nitrogen are probably increasing in this segment. According to the 1996 Surface Water Quality Inventory, water quality in this segment is good, except that barium levels in the sediment are elevated. There are no permitted facilities that discharge to this segment. Economic activities in the watershed that could affect water quality include shrimping, oil exploration and production, petroleum refining, shipbuilding, manufacture of offshore equipment, and industrial processing. In agriculture, beef production is significant, and the major crops are cotton, sorghum, and corn.

Aransas Bay (Segment 2471) - This is an enclosed bay system that connects Ayres Bay to the north, Copano Bay to the west, and Redfish Bay to the south. In this area are the Aransas National Wildlife Refuge, Goose Island State Park, a fish hatchery, and a variety of bird sanctuaries. A possible concern is identified for orthophosphate. No other water quality concerns are identified for this segment. Trend analysis shows that the concentrations of arsenic and total phosphorus are probably increasing in this segment. The 1996 Surface Water Quality Inventory states that the water quality of Aransas Bay is good at this time. There are two permitted wastewater discharges to this segment: a municipal discharge from the city of Rockport (2.5 MGD), and a combined domestic discharge from the Lamar WSC (0.034 MGD). Economic activities in the area include shrimping, oil production and exploration, petroleum refining, shipbuilding, manufacture of offshore oil exploration equipment, and industrial processing. In agriculture, beef ranching is significant, and the major crops of the region are cotton, sorghum, and corn.

Copano Bay and Mission Bay (Segment 2472) - Copano and Mission Bays are shallow secondary bays that receive freshwater inflows from the Aransas and Mission Rivers and exchange directly with Aransas Bay. There are no concerns in this segment. Possible concerns are apparent for phosphate and orthophosphate, and barium levels are elevated. The 1996 Surface Water Quality Inventory reports that chlorophyll *a* is elevated in the lower portion of Copano Bay near its junction with Aransas Bay. Trend analysis shows that the total phosphorous concentration may be increasing, but the chlorophyll *a* concentration is not showing any trend in this segment. There are two combined domestic discharges: one from the town of Bayside (0.011 MGD) and one from the city of Taft (0.9 MGD). Agricultural activity in this area consists primarily of raising grains, corn, cotton, sod, and cattle. Some irrigation is used to farm corn and cotton. Other significant economic activities include oil exploration and production, the production of natural gas, petroleum refining, and the manufacture of petrochemicals.

St. Charles Bay (Segment 2473) - St. Charles Bay is a narrow and shallow secondary bay whose primary inflows are Salt, Artesian, and Willow Creeks (all of which are ungauged peripheral streams). It is a significant breeding area for fish and wildlife. There are no concerns in this segment. Possible concerns are apparent for total phosphate and



orthophosphate. According to the 1996 Surface Water Quality Inventory, the oyster waters use is partially supported in the bay due to elevated fecal coliform densities. Trend analysis shows that the chlorophyll *a* concentration is probably increasing and the total phosphorous concentration may be increasing, but fecal coliform is not showing any trend in this segment. There is one permitted industrial wastewater discharge from the Aransas County MUD (0.07 MGD). Economic activities in the area include fishing, shrimping, production of natural gas, petroleum, petrochemicals, and oil, as well as refining, shipbuilding, manufacture of offshore equipment, and industrial processing. In agriculture, cow-calf operations are significant, and the major crops are cotton, sorghum, and corn.

Nueces Bay (Segment 2482) - Nueces Bay is a shallow, open water bay that lies to the west of Corpus Christi Bay. No concerns are identified for this segment. Possible concerns include total phosphate and orthophosphate. According to the 1996 Surface Water Quality Inventory, due to elevated fecal coliform densities, the oyster waters use is not supported in an isolated area near White's Point and is only partially supported throughout most of the rest of the bay. Cadmium and zinc levels are elevated. Trend analysis shows that the total phosphorous concentration may be increasing, but the fecal coliform densities and zinc concentrations are not showing any trends in this segment. There are three permitted wastewater discharges to this segment: one industrial wastewater discharge from Central Power and Light (500.0 MGD), a combined domestic wastewater discharge from the city of Portland (2.5 MGD), and a combined domestic wastewater discharge from Portland Enterprises DBA (0.009 MGD). Important economic activities in the area include petroleum processing and production, manufacturing, and coastal shipping. There is a wide range of agriculture including beef production, cotton, grain, sorghum, and corn crops. Some irrigation is used to produce corn and cotton.



Nueces-Rio Grande Coastal Basin Identified Water Quality Issues:

Petronila Creek above Tidal (Segment 2204) - This segment extends from the upper limit of the Petronila Creek Tidal segment up to the confluence of Agua Dulce and Banquette Creeks. Identified concerns include total phosphate, orthophosphate, chloride, sulfate, and total dissolved solids, particularly in the lower 25 miles of the segment. The identified possible concerns include total phosphorus and orthophosphorus. According to the 1996 Surface Water Quality Inventory, concentrations of barium have exceeded screening levels in the lower 30 miles. There are six permitted wastewater discharges to this segment: five of them are combined domestic discharges totalling no more than 0.57 MGD, and one of them is a private domestic discharge from the Coastal Bend Youth City, Inc. (0.015 MGD). The region is dominated by oil and gas production and exploration. Agricultural activities include raising cattle, cotton, sorghum, wheat, and corn, which requires some irrigation. Documented water pollution problems in this segment have been attributed mainly to brine waters and leaching from deposits left by past oil field activity. Brine waters are a characteristic by-product from the oil-bearing formations in this region. The end of pipe discharge of brines into this segment ceased in 1987, so it is anticipated that water quality will improve over time in this segment and that this will have a long-term beneficial effect on the ecological health of this stream.

Corpus Christi Bay (Segment 2481) - Corpus Christi Bay is a large, open water bay that is directly to the west of the Padre/Mustang barrier island complex, which separates it from the Gulf of Mexico. It receives freshwater inflows from the Nueces River and the Lake Corpus Christi/Choke Canyon reservoir system. Surrounding water bodies include Redfish Bay to the north and the Upper Laguna Madre to the south. This is one of the most important estuarine systems along the Texas Gulf coast; it recently became the 21st estuary to be nominated into the National Estuary Program. The only water quality problem identified through the screening analysis is a possible concern for total phosphate. The 1996 Surface Water Quality Inventory reports that the exceptional aquatic life use is partially supported due to depressed dissolved oxygen levels in the Corpus Christi Inner Harbor. Due to elevated fecal coliform densities, the oyster waters use is not supported in an isolated area near the mouth of Oso Bay. The oyster waters use is partially supported in a larger area along the southwestern side of the bay. The duration, extent, and area of actual shellfish closures are based on criteria administered by the Texas Department of Health. Trend analysis shows that fecal coliform densities are probably decreasing in this segment. Arsenic, barium, and zinc levels in sediment are elevated. Trend analysis shows no trends in arsenic concentrations, but zinc concentrations are possibly decreasing, and total phosphorus and mercury concentrations are probably increasing. There are 14 permitted wastewater discharges to this segment: one municipal discharge from the city of Gregory (0.32 MGD); six combined domestic discharges including the city of Ingleside (1.72 MGD), the city of Portland (0.2 MGD), and Nueces County WCID (1.38 MGD); and seven industrial discharges including E. I. du Pont de Nemours & Co. (3.1 MGD), U.S. Department of the Navy (2.0 MGD), and Occidental Chemical Corp. (1.6 MGD). The area produces large quantities of grain and sorghum as well as cotton and corn, requiring heavy dependence on irrigation. Major economic activities include petroleum processing and production, coastal, shipping,

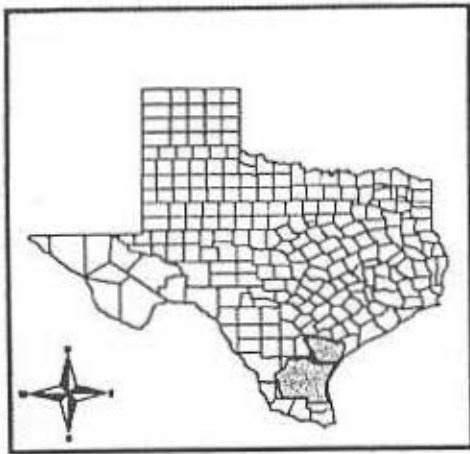


industrial manufacturing, and fishing. The largest percentage of the basin's population lives in this watershed, and impervious surfaces and development cover much of the area.


Corpus Christi Inner Harbor (Segment 2484) - This is a man-made navigation channel that connects the Port of Corpus Christi to Corpus Christi Bay. The channel is 7 miles long and dredged to 45 feet. A concern is identified for ammonia nitrogen, and possible concerns include total and orthophosphate. According to the 1996 Surface Water Quality Investigation, the aquatic life use is not supported because the mean dissolved copper concentration exceeds the chronic criterion. Depressed dissolved oxygen levels in the Avery and Viola Turning Basins cause partial support of the intermediate aquatic life use. One fish kill, which was reported in September 1990, was due to low dissolved oxygen. Cadmium, copper, lead, mercury, zinc levels in sediment, and PCBs and selenium in whole fish tissue are elevated in the Corpus Christi Inner Harbor. Trend analysis indicates a probable increase in lead concentrations and a probable decrease in zinc and total phosphorus concentrations. There are no significant natural freshwater inflows to the channel, although the city of Corpus Christi stormwater outlets and runoff from the surrounding industrialized areas flow into the channel. There are one permitted municipal wastewater discharge from the city of Corpus Christi (10.0 MGD) and 29 industrial wastewater discharges, including American Chrome and Chemicals (23.15 MGD), Koch Refining Company (3.2 MGD), and Valero Refining (4.25 MGD). This segment is the most heavily industrialized water body in the Nueces Coastal Basins. The total cargo tonnage for the Port of Corpus Christi in 1994 was more than 78 million tons, which ranks the port second in Texas and sixth in the United States in total cargo tonnage handled per year. The Industrial and Hazardous Waste Section of the TNRCC, in cooperation with the TNRCC regional office in Corpus Christi, is conducting an in-depth investigation of the impacts of this industrial complex on the Inner Harbor. The harbor was dredged in 1988 to a depth 5 feet deeper than it had been previously. This may have removed contaminated sediment; however, runoff from the dredge spoil which was disposed of adjacent to the harbor may reintroduce contaminants to the harbor or to Nueces Bay. Many of the wastewater discharge permits have been rewritten recently based on toxic substance criteria, which should result in reduced pollutant loadings and eventual decreases in chemical concentrations.

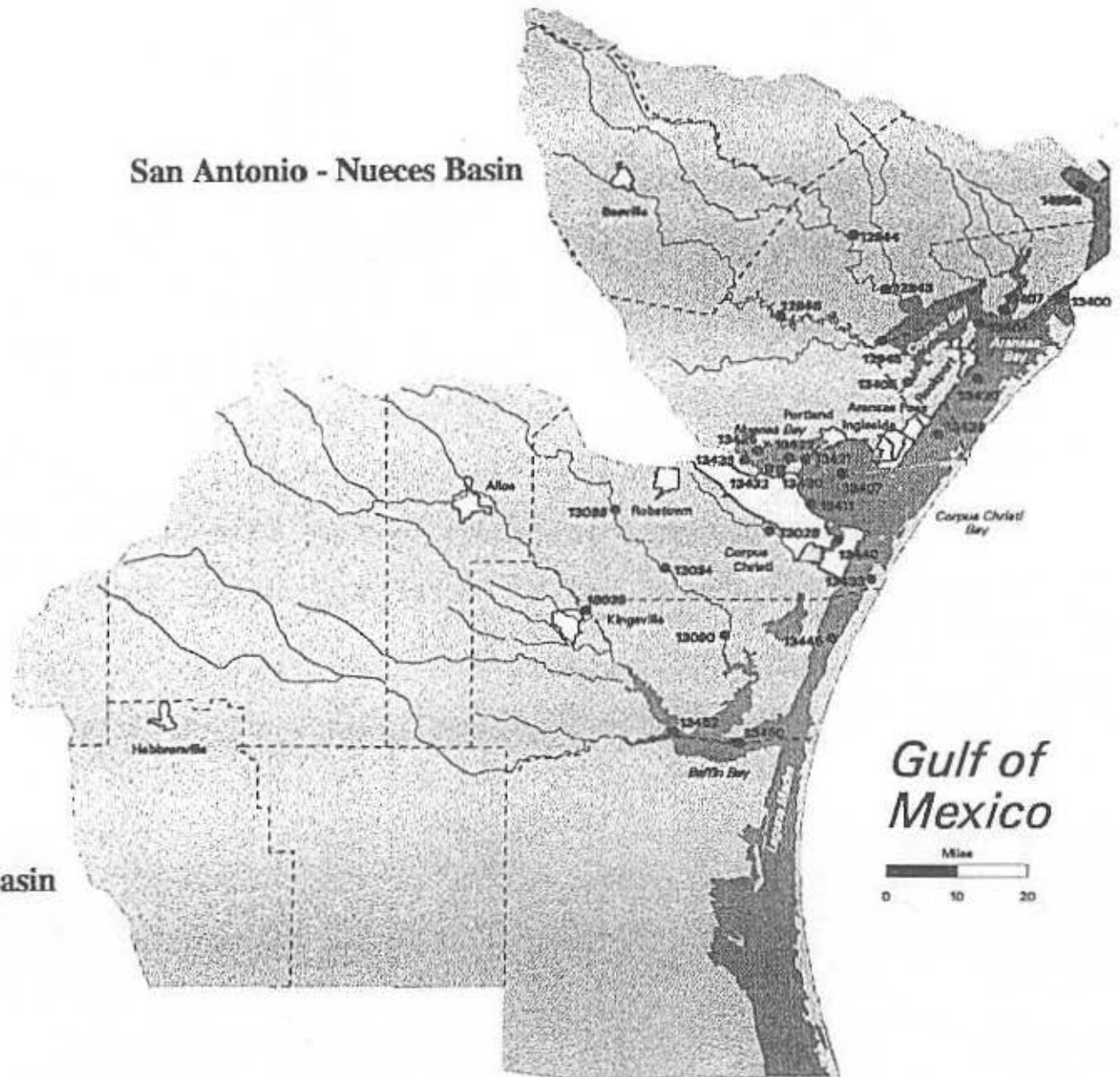
Oso Bay (Segment 2485) - Oso Bay is an enclosed, secondary bay off the south shore of Corpus Christi Bay. It receives freshwater inflows from Oso Creek and exchanges only with Corpus Christi Bay. A concern is identified in this segment for total phosphate. Possible concerns are identified for ammonia nitrogen, orthophosphorus, total phosphorus, dissolved orthophosphorus, and fecal coliform. The 1996 Surface Water Quality Inventory reports that depressed dissolved oxygen levels in the lower portion of the bay contribute to partial support of the exceptional aquatic life use. Due to elevated fecal coliform densities, the oyster waters use is not supported, and the contact recreation use is partially supported. Trend analysis shows that fecal coliform densities may be decreasing. Documented water quality problems may be due to the nine permitted wastewater discharges to this segment: three industrial discharges, including Central Power and Light Company (540.0 MGD) and Oxy Petrochemicals (3.2 MGD); four combined domestic discharges, including the city of Corpus Christi (24.2 MGD) and the city of Robstown (3.0 MGD); one municipal discharge

Map A: FY '98-'99 TNRCC Water Quality Monitoring Stations

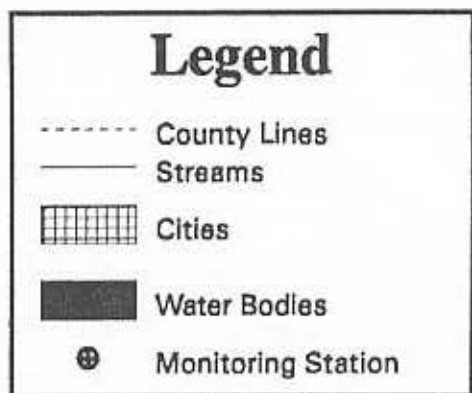
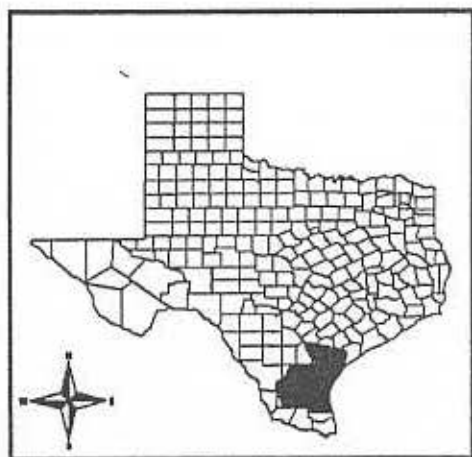


Legend

- - - - - County Lines
 - - - - - Streams
 Cities
 Water Bodies
 • TNRCC Region 14 Monitoring Station
 • TNRCC CRP Monitoring Station







Map B: FY '97 TNRCC Water Quality Monitoring Stations



Map E: Corpus Christi Bay National Estuary Program (CCBNEP) Study Area



LEGEND

-  CCBNEP Study Area
-  Nueces River Basins
-  Area Assessed in Rio Grande
-  Water

